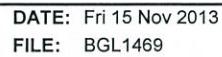


Appendix Two – Dynamic Cone Penetrometer Profiles DCP-1 to DCP-7

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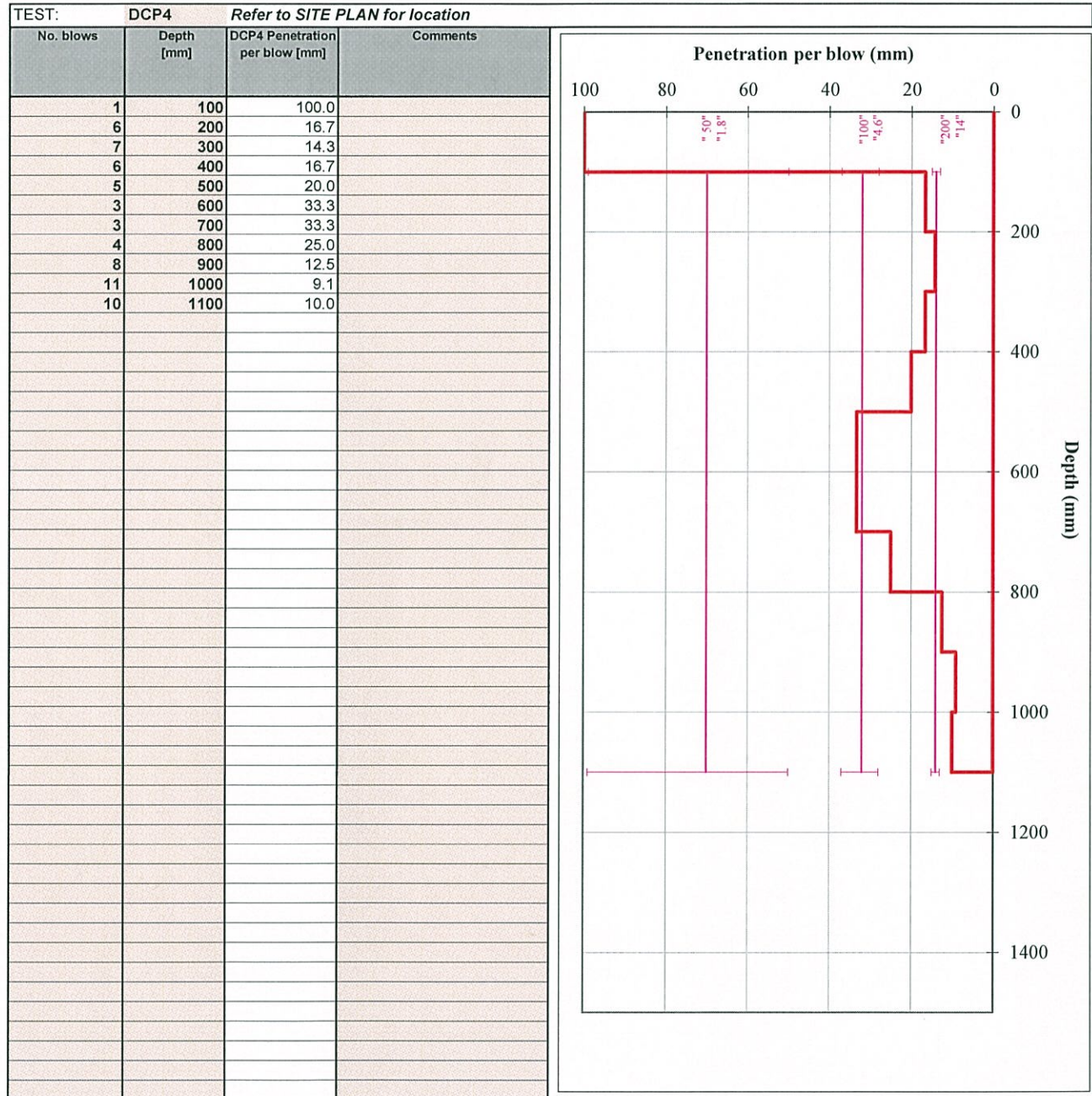


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DATE: Fri 15 Nov 2013  
FILE: BGL1469

## SCALA PENETROMETER TESTS





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## APPENDIX 3

### COFFEY GEOTECHNICAL ROCKFALL REPORT

Site specific to 23K Walkers Road, Lyttelton.

26 November 2014

Our ref: GENZCHRI15792AA

J. Oakley

23K Walkers Road  
Lyttelton, Christchurch

Dear Julia

## **ROCKFALL ASSESSMENT OF THE OAKLEY PROPERTY AT 23K WALKERS ROAD, LYTTELTON, CHRISTCHURCH**

### **1. Introduction**

Coffey Geotechnics (NZ) Limited (Coffey) is pleased to provide this rockfall assessment of your property at 23K Walkers Road (hereinafter referred to as the "site"). Coffey was commissioned by Julia Oakley (hereinafter referred to as the "Client") the owner of the address stated above to provide a professional perspective of the rockfall hazard at a site-specific level that could be used to support an appeal submission to the pending Christchurch District Plan zoning decision.

The Client had already engaged Bell Geoconsulting Limited ("Bell") to carry out a geotechnical report<sup>1</sup> that focussed on the proposed building platform for the proposed new dwelling. Coffey's site walkover assessment and letter were requested by the Client to provide further geotechnical opinion of the whole site.

### **2. Scope of works**

The scope of works has been presented to the Client in our proposal dated 31 October 2014 and is summarised below:

- Perform a site walkover – geological mapping of the hillside.
- Provide a letter summarising our walkover observations.

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<sup>1</sup> David H Bell (PEngGeol); Bell Geoconsulting Limited; Geotechnical Report – New Dwelling – 23K Walkers Road, Lyttelton; BGL Ref. 1469/03; Dated 10 October 2014.



### 3. Site description

The property, 23K Walkers Road, is situated in the Christchurch Port Hills suburb of Lyttelton. The property is located on an easterly facing ridge located as shown on Figure 1. The site is split into two zones, residential (where the new dwelling will be located) and rural (no building will be carried out in this area).



Figure 1: Site location plan (scale as shown)<sup>2</sup>

Presently, the site is uninhabited and the proposed building platform has been partly excavated. Evidence of trial pits (from the BGL geotechnical report) could be seen in the building platform. The residential zone is covered by tall grass, whereas further upslope in the rural zone, very dense scrubby vegetation (typically gorse and broom) covers the hillside.

A topographical survey was carried out for the Client by Davis Ogilvie<sup>3</sup>; the residential zone of the site rises gently from approximately 121mLDD (Lyttelton Drainage Datum) on the eastern boundary, to approximately 137mLDD at the north western corner of the residential zone. This is over a distance of approximately 55m that equates to an average slope angle of 16°. The rural zone has a "stepped" slope, with numerous wide (up to 10m) naturally formed benches in-between the steepening slope. The overall slope angle measured in the rural section was between 21 - 22°. Near the crest of the rural zone the slope angle steepens and occasional, well embedded boulders and in-situ rock outcrops are present beneath the dense scrubby vegetation.

<sup>2</sup> Aerial imaging sourced from Google Earth.

<sup>3</sup> Davis Ogilvie; Topographical survey over Lot 10 DP 403721; 23K Walkers Road, Lyttelton, Christchurch; Reference 32209; 18 November 2013.

#### 4. Site geology

The soils observed during the site walkover in the partially cut building platform ("*pale-brown windblown silt of Banks Peninsula*") commonly known as Loess) are consistent with those published on the geological map<sup>4</sup> and described in the Bell report for the area.

No shallow ground investigation has been carried out by Coffey on the site, however following the site walkover it is considered that similar ground conditions will be encountered throughout the site (comprising loess over volcanic bedrock). From observing the rock outcrop just outside the western boundary of the rural zone (at the crest of the slope) of the site the bedrock can be described as basalt. Based on the geology map, the Bell report, and our site walkover, the basalt bedrock is likely located at depths of less than 1m to over 4m within the residential zone of the site and from the surface to a depth of less than 1m within the rural zone of the site.

#### 5. Site walkover observations

A site walkover to assess the geotechnical hazards present at the site was carried out on 7 November 2014 by Mr Adam Broadbent and Mr Bjorn Raasch, Adam being a suitably qualified Coffey senior engineering geologist experienced in the Port Hills region.

The Client was available for an interview and indicated that no rockfall triggered by the 22 February and 13 June 2011 earthquakes had affected the site. The Port Hills Geotechnical Group (PHGG) maps "*Location of fallen and in-situ boulders and bluffs*" map 90 also concurs with this. The PHGG map does show evidence of fallen and in-situ boulders and localised areas of in-situ bluffs approximately 200m to the southwest of the site. These features were observed during the site walkover and pose no risk to the site.

The most pertinent observations from the site walkover are summarised below and are displayed in Figure 2:

- There were no observed boulders in the residential zone.
- The slope angle of the residential zone was approximately 16° (rising to the west).
- The partially excavated proposed building platform had evidence of the trial pits from the Bell geotechnical investigation.
- There was a small rock outcrop (source area 1) at the crest of the slope at the very edge of the rural zone of the site.
- Slope angle and vegetation density increased in the rural zone of the site (rising to the west).
- Source area 2 poses no risk to the site due to topography (see Figure 2).

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<sup>4</sup> Canterbury Geotechnical Database (CGD) reference: "Published Maps and Reports - Geological Maps - Christchurch Geology -1992.



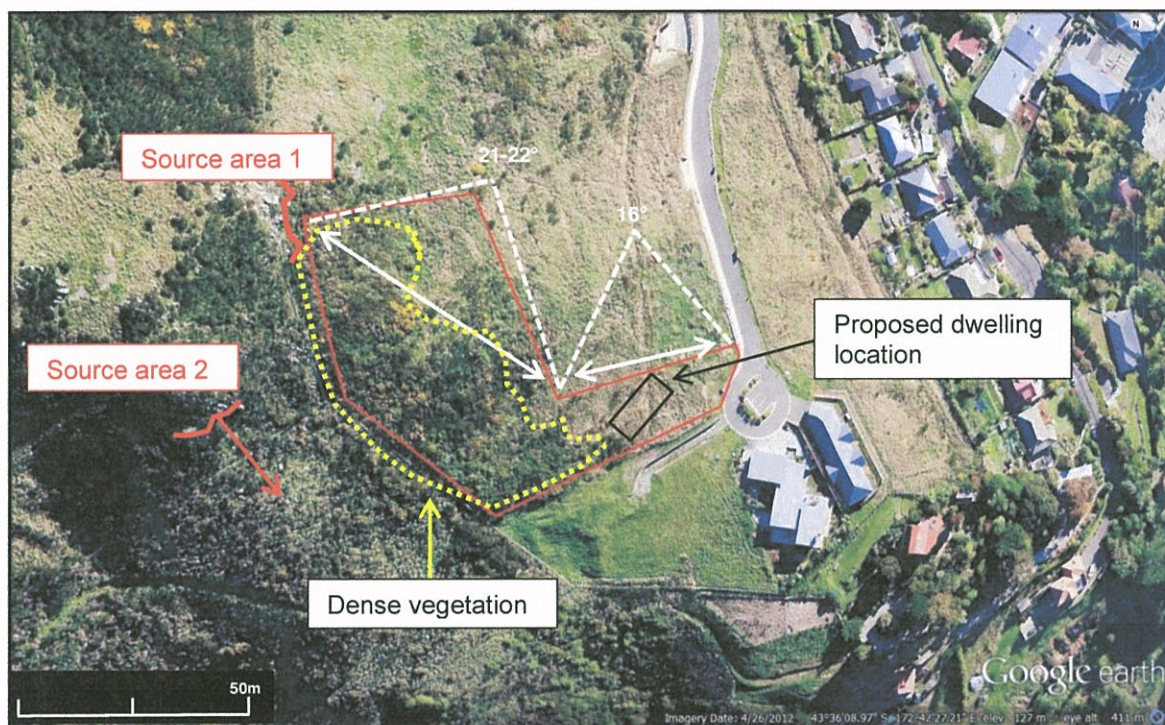


Figure 2: Site observations summary (scale as shown)<sup>5</sup>

## 6. Conclusion and recommendations

Following the site walkover assessment, Coffey is of the opinion that the site has a very low risk from the geo-hazard of rockfall.

The source area 1 rock is considered to be intact and at very low risk of rolling into the site. Historic boulders on the steeper part of the rural zone were observed to be well embedded into the slope.

For hazard mitigation measures for land use resource consent applications, it is believed that this assessment has been carried out using standard practice methods. Following application of the observations summarised above, it is believed that the risk to life is at an acceptable level.

In this regard, Coffey is of the opinion that consideration should be given to modifying the district plan zoning map to exclude the site from the Rockfall Hazard Management areas 1 & 2. For future residential development per the Residential Banks Peninsula zone on the revised District Plan, it is advised that planting is carried out in the western rural zone of the site for added protection, even though the risk of rockfall is considered very low.

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<sup>5</sup> Aerial imaging sourced from Google Earth.

## 7. Limitations

This report has been prepared solely for the use of our Client and their professional advisers and in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity.

The opinions, recommendations and comments given in this report result from the application of normal methods of site investigation. As factual evidence has been obtained solely from observation and mapping methods that by their nature only provide information about readily visible features, there may be special conditions pertaining to this site that have not been disclosed by the investigation and that have not been taken into account in the report. If variations in the surface features occur from those described or are assumed to exist, then the matter should be referred to us immediately.

Please also refer to the enclosed *Important Information about Your Coffey Report*.

## 8. Closure

If you have any queries or you require any further clarification on any aspects of this report, please contact the undersigned.

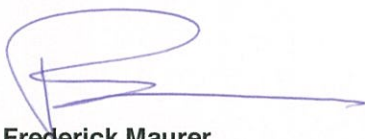
For and on behalf of Coffey

Prepared by



**Adam Broadbent**  
BSc  
Senior Engineering Geologist

Reviewed by



**Frederick Maurer**  
BSc MSc CE (Calif) GE (Calif) MIPENZ  
Principal Geotechnical Engineer

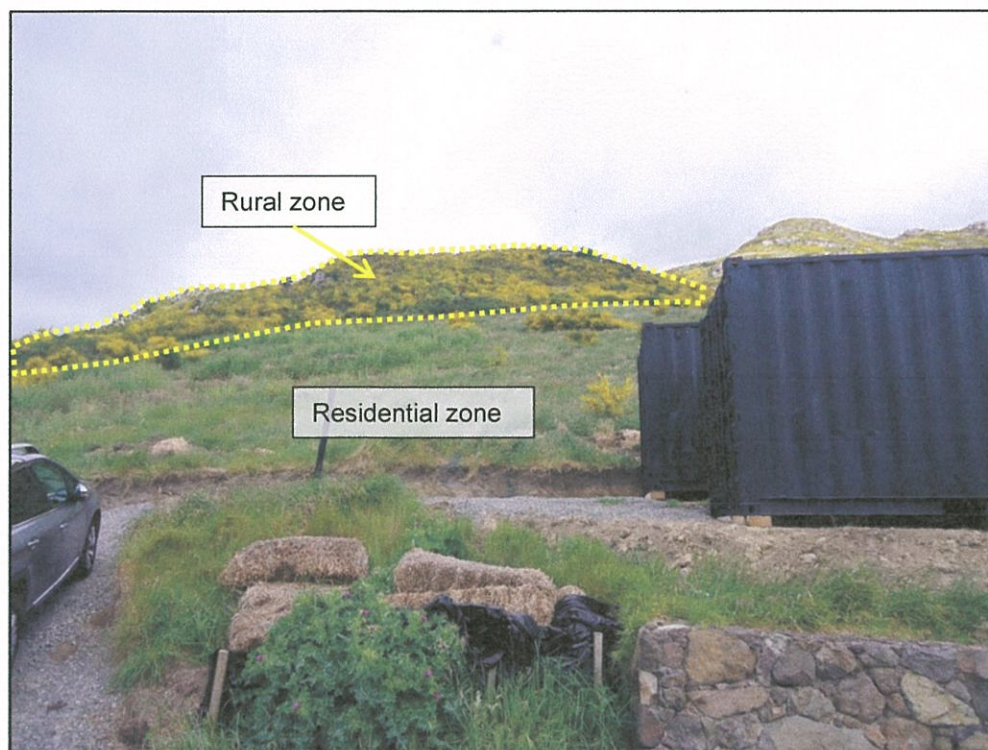
Attachments

Important information about your Coffey report.

Appendix A: Site photographs



## **Appendix A - Site photographs**



Photograph 1: Looking west to the crest of the slope through the site.



Photograph 2: Looking west up to the crest of the slope and source area 1.





Photograph 3: Historic boulder near the crest of the slope – well embedded and very low risk.



Photograph 4: Source area 1 – Intact, well embedded in-situ rock.

## Important information about your Coffey Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

### **Your report is based on project specific criteria**

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

### **Subsurface conditions can change**

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

### **Interpretation of factual data**

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time.

The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

### **Your report will only give preliminary recommendations**

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

### **Your report is prepared for specific purposes and persons**

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.



## Important information about your Coffey Report

### Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

### Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

### Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks.

If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

### Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

### Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.